

## **GUIDED BONE REGENERATION IN THE ORAL CAVITY: A REVIEW**

### **ABSTRACT**

This paper is a review on Guided Bone Regeneration. Guided Bone Regeneration is a surgical procedure uses barrier membrane to direct new bone growth for function and prosthesis placement of bone defects and also to enhance the bone volume in deficient recipient sites prior to implant placement and periodontal regenerative therapy. The barrier membrane acts as a physical barrier, excluding competing and non-osteogenic cells from the overlying mucosa into the membrane-protected space.

### **KEYWORDS:**

Guided bone regeneration, ridge preservation, implants, dental implants, extractions

### **CONTRIBUTORS:**

1. Dr.T Sridhar, MDS
2. Dr.B Karthika, MDS
3. Dr.Shilpa Ann Mathews, BDS
4. Dr.Karoiln Sumi, BDS

### **Department and Institution:**

Department of Oral Medicine and Radiology,  
Priyadarshini Dental College and Hospital, Thiruvallur city, Tamil Nadu

### **Corresponding Author:**

Dr.Shilpa Ann Mathews,BDS

## INTRODUCTION

GBR used for infection management, controls pathogens and immune inflammatory response. It is used for scaling and root planning, repopulates the exposed root surface and periodontal tissue regeneration and also flap debridement or flap curettage and resective procedures[1].

Guided orthodontic bone regeneration (GOBR) technique used to regenerate soft tissue and restorate tooth in aesthetic zone due to external resorption or to create a new hard-soft tissue for adjacent teeth of extracted tooth[2]. Non self-healing large bone defects such as large cortical defects due to trauma, infections, tumor resection, aseptic implant loosening and skeletal abnormalities also uses GBR[3].

In recent decades, Guided bone regeneration procedures is for alveolar augmentation and repair bone deformaties due to pathological lesions[4].

Guided bone regeneration(GBR), which regenerates lost alveolar bone and promotes hard tissue formation by using a barrier .It is used to give new bone in preparation for implant-site development (eg , in ridge augmentation ,around exposed threads of implants). As time passed, predictable intraoral GBR was introduced for localized ridge augmentation and to correct of dehiscence around implants[5]

GBR is used to enhance fixed partial denture.To restore deficient contours under a pontic will facilitate the more natural emergence profiles, prevent altered phonetics due to space between prosthesis and tissues[6].

## GUIDED BONE REGENERATION

The GBR therapeutic protocol includes surgical placement of a cell occlusive membrane that faces the bone surface, to physically seal off the skeletal site in need for regeneration. The characteristics of barrier membranes include biocompatibility, cell occlusion properties, integration by the host tissues, clinical manageability and space making ability .

In the mid-1980s, GBR treatment concept was developed on regard of the GTR principle. Hence, the GBR biological rationale advocated the mechanical exclusion of undesirable soft

tissues into the osseous defect, hence allowing osteogenic cell populations taken from the parent bone to repopulate the osseous wound space[7].

The evidence on GBR in an attempt to reconstruct large osseous defects in the jaws and for the treatment of the atrophic maxilla or mandible. It is known to repair the bone defect, the rate of osteogenesis extends inward from the adjacent bone ends must exceed the rate of fibrogenesis from the surrounding muscle or connective tissue[1]

The principle of selective cell repopulation is used to enhance site development for implant placement. Whereas GTR requires to regenerate the bone, PDL and cementum for new periodontal apparatus, the requirements for implant site. After tooth extraction the socket can be augmented with a graft material and sealed with a barrier membrane. In some cases, a membrane used without graft material in the socket. This procedure is known as ridge preservation. Similarly, in GBR a large deficiency of alveolar ridge can be improved with the use of graft material and a barrier and is used for osseous ridge augmentation[8]

#### **PREREQUISITES OF IDEAL BARRIER MEMBRANE INCLUDES:-**

Biocompatibility, cell occlusivity, tissue integration, space-making effect, and clinical manageability. Absorbable collagen membranes has high biocompatibility with oral tissues, haemostatic properties, chemotactic effects on fibroblasts, ensuring adequate wound closure and lack of need for retrieval and this absorbable membranes are made of collagen or of polyglycolic acid, polylactic acid, or copolymers. Mini screws or surgical bone tacks is used successfully to stabilize membranes[9]

. For successful GBR, four principles needed: exclusion of epithelium and connective tissue, space maintenance, stability of the fibrin clot, and primary wound closure.

After GBR procedures, bone regeneration evolves through a sequence of events. Within the first 24 hours after a bone graft. The clot is absorbed and replaced with granulation tissue which is rich in newly formed blood vessels and lastly contributes to osteoid formation. Later it serves as a template for the apposition of lamellar bone eventually constitute both compact and reticular bone with mature bone marrow. These events occur in a duration of 3 to 4 months after surgery[10]

## PRINCIPLES OF GUIDED BONE REGENERATION

Controls the proliferation of the periodontal ligament cells and prevent the contact from epithelium and connective tissues, the space-maintaining capability allowed for regeneration of the attachment apparatus of the tooth. Buser et al. introduced the basic principles of “guided bone regeneration” (GBR), that is providing the cells from bone tissues with a space intended for bone regeneration away from the surrounding connective tissue, by inserting barrier membranes to a bone defect. The principles and limitations of each method suggest that GBR procedures are a better solution to non-membrane supported healing. This paper discusses about the guided tissue and bone regeneration[11]

The GBR barrier possess the following properties:

*Cell exclusion:* In GBR, the barrier membrane prevents the gingival fibroblasts and or epithelial cells from gaining access to the wound site to form fibrous connective tissue.

*Tenting:* The membrane is closely attached and in such a way that the space created beneath the membrane, completely isolating the defect to be regenerated from the overlying soft tissue.

*Scaffolding:* This tented space initially becomes occupied by a fibrin clot, which serves as a scaffold for the in-growth of progenitor cells

*Stabilization:* The membrane should protect the clot from the movements of overlying flap during healing.

*Framework:* In non-space maintaining defects such as dehiscences or fenestrations, the membrane must be supported to prevent collapse stiffer membranes like titanium-reinforced membranes have also been used for this purpose[12]

## FACTORS AFFECTING SUCCESSFUL REGENERATION

1. Primary soft tissue closure and healing
2. Use appropriate barrier membrane
3. Stabilization and close adaptation of membrane to the surrounding bone
4. Creation and maintenance of a secluded space
5. Sufficiently long healing period for about nine months[9]
6. Bacterial contamination
7. Smoking

8. Diabetes
9. Membrane Exposure
10. Gingival thickness
11. Space maintenance[1]

## **BARRIER MEMBRANE**

Barrier membranes control tissue or bone regeneration (GTR and GBR).

The mechanical barrier between the bone defect and the soft tissue controls the formation of more quickly proliferating cells in the overlying mucosa by covering an existing bone defect or artificially created cavity with a membrane, and permits the population of defect with bone-forming cells[1]

## **FUNDAMENTAL REQUIREMENTS OF BARRIER MEMBRANE**

### 1. Biological compatibility

This includes the removal or deactivates the foreign proteins with sensitization

### 2. Barrier function

Unwanted tissues should be removed, but the nutrients must be able to diffuse easily.

### 3. Tissue integration or Biological adhesion

The tissue should grow into the membrane, but not through it.

### 4. Space-retainer function or Form stability

Sufficient stiffness should be present which avoids the membranes from collapsing into the bone defect under the pressure of soft tissue.

### 5. Adaptability or Handling

Collagen membranes virtually adapt themselves, it can stretch to some degree and can therefore be directly adapted in the patient's mouth to the corresponding morphology, and later can also be cut to size[13]

## **NON-RESORBABLE MEMBRANES**

Non-resorbable membranes are expanded, high-density and Titanium-reinforced e-PTFE (e-PTFE, d-PTFE and Ti-e- PTFE) and titanium mesh (Ti-mesh).

PTFE membrane

The advantages of d-PTFE, on their membranes which has 0.2 µm submicron pores. The advantage of d-PTFE over e-PTFE as they prevent infections and easy operation for removal [11].

### **RESORBABLE MEMBRANES**

The advantage of resorbable membranes is a single-step procedure, and the degradation of membrane is the disadvantage.

Synthetic resorbable membranes

Polyesters [e.g., poly (glycolic acid) (PGA), poly (lactic acid) (PLA), poly (ε-caprolactone) (PCL) and their co-polymers. Collagen and aliphatic polyesters, (polyglycolide or polylactide), are derived from different origins.

Membranes based on natural materials

Derived from human skin, bovine achilles tendon or porcine skin, and can be characterized by their better cell affinity and biocompatibility[11]

### **GBR WITH BONE GRAFTING**

The bone graft rationale: - osteogenic, osteoinductive, or osteoconductive properties possessed by the grafting materials.

1 Osteogenic material stimulates the formation of new bone which are present within the graft itself. Osteo inductive materials stimulate new bone formation in the surrounding tissue.

Osteoconductive materials helps as scaffolds for bone growth within existing bony walls.

2 Sources of bone grafts are autografts, allografts, xenografts, and alloplasts.

Autografts are taken from extra- or intraoral sites and implanted in the same patient. Allograft uses grafts from different patient but same species,

xenografts uses grafts from one species to another and synthetic alloplasts have been used to treat periodontal defects[14]

## COMPLICATIONS

High failure rate because of dehiscences with exposition and early membrane loss.

Membrane exposure in the healing phase is taken as a complication. For periodontal surgery, exposure of the membrane (GTR) leads only to a minor or clinically irrelevant failure therapeutic result when compared to GBR membrane exposure.

Smoking and diabetics can influence the GBR success rate.

Once exposed, non-resorbable membranes should be removed to avoid infection.

Nevertheless, bacterial collagenases in the exposed area leads to early degradation of the collagen structure and lead to reduced barrier function with less bone infilling and reduce degradation by cross linking and improves their structural properties[15].

## CONCLUSION

Hence it is concluded that GBR is very important in dentistry and it is used in the field of periodontics, orthodontics, prosthodontics and oral surgery .Guided bone regeneration enhanced the preservation of hard and soft tissue contour. Guided bone regeneration can be achieved with using particulate autogenous bone grafts, allografts, xenografts, or alloplasts grafting materials and resorbable or non-resorbable barrier membranes techniques.

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